

REMARKS

Claims 15-34 are pending in the subject application. New claims 44 and 45 have been added by amendment above. Support for new claim 44 can be found at page 13, lines 1-7. Support for new claim 45 can be found in the specification at page 21, lines 17 and 18. Accordingly, claims 15-34 and 44-45 are pending and active.

New claim 44 specifically recites when the higher current electroplating power is initiated, i.e., immediately after the first predetermined period of time. New claim 45 recites in an alternative manner when the higher current electroplating power is initiated. New claim 45 recites that the higher current electroplating power is initiated after a thickness of noble metal deposited during the first predetermined time period has increased beyond a predetermined magnitude. As discussed below, the applied references do not teach or suggest when the higher current electroplating power should be applied.

Claim 15 is the sole independent claim. The balance of the claims depend from claim 15. Claim 15 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,256,274, to Poris et al., in view of the Lowenheim text entitled *Electroplating* and U.S. Patent No. 5,685,970, to Ameen et al. Dependent claims 16-34 are rejected over Poris et al. in view of Lowenheim and Ameen and further in view of a variety of secondary references. In the interest of brevity and in the interest of focusing the issues, applicants traverse the rejection of claims 15-34 over Poris et al. in view of Lowenheim and Ameen et al. for the reasons below. The reasons given below are equally applicable to dependent claims 16-34 in view of the dependence of these claims from claim 15.

The Poris et al. patent, as the Examiner acknowledges, describes a conventional copper electrolytic plating process used in the manufacture of semiconductor devices. There is no suggestion in the Poris et al. patent that the electrolytic deposition process should be carried out

in two stages, one at a low current and a second with a higher current to deposit a noble metal into submicron features on the surface of a microelectronic workpiece. Poris et al. fails to teach, as the Examiner recognizes, the step of increasing the current to achieve a higher current density.

The Examiner relies on the secondary references, namely, the Lowenheim text and the Ameen et al. patent for teaching the concept of plating at a low current for a first predetermined period of time followed by the application of a higher current electroplating power for a second predetermined period of time. The Lowenheim text is a general textbook, and is concerned with plating operations such as depositing an electrically conductive film onto a nonconductive surface such as a plastic. This is noted by the Examiner on page 5 of the Examiner's Action. The Ameen et al. patent is similar to the Lowenheim text and teaches a method for metallizing polymeric films through an electrodeposition process.

There is no suggestion in the applied art to combine the teachings of the secondary Lowenheim text and Ameen et al. patent with those of the primary Poris et al. patent as required by the law of obviousness. To the contrary, techniques employed in the electroplating of metals onto plastics represent an entirely different field of endeavor as compared to depositing copper films on semiconductor wafers which is the purview of the primary reference. There is no similarity in the substrates of the secondary references and the substrates of the primary reference or the respective problems that these distinct substrates pose to those skilled in the art. No one skilled in the art would be led by the teaching of either the Lowenheim text or the Ameen et al. patent to modify the methods disclosed in Poris et al. for electroplating metals onto semiconductor wafers. The secondary Lowenheim and Ameen et al. references and their teachings related to plating conductive films onto plastic or polymeric substances are simply not relevant to Poris et al., and therefore the Examiner's rejection as set forth in the Examiner's

Action represents an improper hindsight reconstruction of the subject matter claimed by applicant.

Furthermore, new dependent claims 44 and 45 define conditions after which the higher current electroplating power is applied. Claim 44 defines this condition as "immediately after the first predetermined period of time." Claim 45 defines this condition as "after a thickness of noble metal deposited during the first predetermined time period has increased beyond a predetermined magnitude." None of the applied references discloses or suggests any such conditions for when the higher current electroplating power is applied.

For the foregoing reasons, the subject matter of independent claim 15, claims 16-34, and new claims 44 and 45 are not obvious over Poris et al. in view of the Lowenheim text and the Ameen et al. patent. The secondary references applied in rejecting claims 16-34 do not supply what is missing from the combination of Poris et al., Lowenheim, and Ameen et al. Accordingly, the rejection of claims 15-34 over Poris et al. in view of the Lowenheim text and the Ameen et al. patent and the various other secondary references should be withdrawn.

In a similar manner, independent claim 15 and dependent claims 16-34 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,789,320, to Andricacos et al., in view of U.S. Patent No. 6,236,079, to Nitayama, or U.S. Patent No. 5,595,928, to Lu et al., and further in view of the Lowenheim text and the Ameen et al. patent. The subject matter of independent claim 15 and dependent claims 16-34 is nonobvious over the references applied in this rejection for the same reasons that claims 15-34 are nonobvious over Poris et al. in combination with Lowenheim and Ameen et al. Neither Nitayama or Lu et al. provides any motivation to combine the teachings of the primary Andricacos et al. reference with the secondary Lowenheim and Ameen et al. references. Andricacos et al. describes an electrolytic plating process for deposition of noble metals used in the manufacture of semiconductor devices.

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There is no suggestion in the Andricacos et al. patent that its electrolytic deposition process should be carried out in two stages, one with a low current power and a second with a higher current electroplating power to fill submicron features on a microelectronic workpiece.

Like Poris et al., Andricacos et al. fails to teach, as the Examiner recognizes, a method for electroplating a noble metal into submicron features that employs a low current electroplating power followed by a higher current electroplating power. As with the rejection based on Poris et al., the Examiner relies on the secondary references, namely the Lowenheim text and the Ameen et al. patent, for teaching the concept of a low current electroplating power followed by a high current electroplating power. As stated above, there is no suggestion in the applied references to combine the teachings of the secondary references of Lowenheim and Ameen et al. with those of the primary Andricacos et al. reference as the law of obviousness requires. The secondary references describe techniques employed in the electroplating of plastics or polymers which represent an entirely different line of endeavor as compared to depositing noble metals on semiconductor wafers which is the endeavor of the primary Andricacos reference. There is no similarity in the substrates or the respective problems that those substrates raise to one skilled in the art. No one skilled in the art would be led by the teachings of either the Lowenheim text or the Ameen et al. patent to modify the methods described by Andricacos et al. in electroplating semiconductor wafers. The secondary references to Lowenheim and Ameen et al. are simply not relevant to Andricacos et al., and therefore the Examiner's rejection as set forth in the Examiner's Action represents improper hindsight reconstruction of the subject matter claimed in this application.

Furthermore, the remarks set forth above with respect to new dependent claims 44 and 45 and their recital of conditions when the higher current electroplating power is initiated are equally applicable to this rejection based on Andricacos et al. Accordingly, the Examiner should

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withdraw the outstanding rejection of claims 15-34 over Andricacos et al. in view of Nitayama, Lu et al., Lowenheim, and Ameen et al., and both new claims 44 and 45.

For the foregoing reasons, the subject matter of independent claim 15 and the claims dependent therefrom is nonobvious over the applied references. Accordingly, the Examiner should withdraw the outstanding rejection and pass the application to issue. If the Examiner has any questions regarding the above, the Examiner is requested to call applicants' attorney at the number listed below so that any outstanding issues can be resolved in a timely and efficient manner.

Respectfully submitted,

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I hereby certify that this correspondence is being deposited with the U.S. Postal Service in a sealed envelope as first class mail with postage thereon fully prepaid and addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on the below date.

Date: 12/12/03

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